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Thermal degradation mechanisms of silicone elastomers

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Polydimethylsiloxane (PDMS) is the most extensively used polymer among silicones. It finds application in an unlimited number of fields, including use in high temperature environments. PDMS meets these demanding requirements, due to its excellent thermal stability. The thermal degradation of linear PDMS occurs by a molecular mechanism or a radical mechanism depending on the temperature and the heating rate.^[1,2] Nevertheless, the thermal degradation of cross-linked PDMS networks has not been thoroughly investigated yet. In this work, the thermal degradation mechanisms and thermal degradation products of silicone elastomers are studied. Thermogravimetric analysis (TGA) performed in inert atmosphere was carried out on PDMS networks synthesized with different stoichiometric ratios (r). Extraction of the samples was exploited to remove unreacted chains, with the aim of determining to which extent the degradation is influenced by the sol fraction and the amount of dangling chains present in the network (Figure 1). Furthermore, long-term isothermal TGA measurements were performed to recover the degradation products of the thermally treated elastomers. Soluble degradation products were analysed by size exclusion chromatography (SEC), while TGA coupled with FTIR was used to detect the released volatile degradation products.

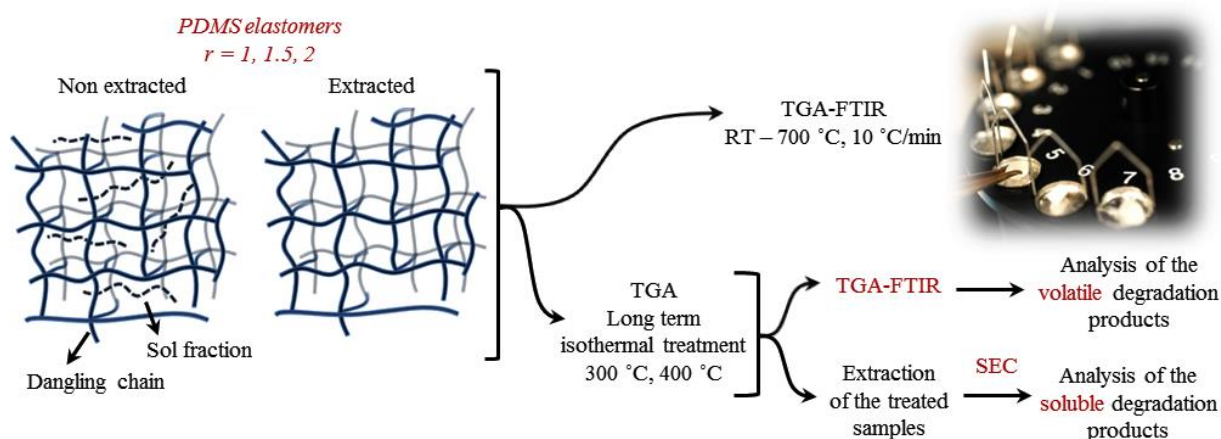


Figure 1. Scheme of the experimental procedure designed to investigate the thermal degradation behaviour of the silicone elastomers before and after removal of the sol fraction by extraction.

[1] G. Camino, S. M. Lomakin, M. Lageard, *Polymer* **2001**, 43, 2011-2015.

[2] N. Grassie, I. G. Macfarlane, *Eur. Polym. J.* **1978**, 14, 875-884.

